

Package: ceRtainty (via r-universe)

July 23, 2026

Type Package
Title Certainty Equivalent
Version 1.0.0.9000
Description Compute the certainty equivalents and premium risks as tools for risk-efficiency analysis. For more technical information, please refer to: Hardaker, Richardson, Lien, & Schumann (2004) <doi:10.1111/j.1467-8489.2004.00239.x>, and Richardson, & Outlaw (2008) <doi:10.2495/RISK080231>.
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Encoding UTF-8
LazyData true
Imports dplyr, RColorBrewer, graphics, stats
Suggests knitr, rmarkdown, testthat (>= 3.0.0)
Config/testthat/edition 3
VignetteBuilder knitr
Config/roxygen2/version 8.0.0
Repository https://arielsotocaro.r-universe.dev
Date/Publication 2026-07-23 16:37:48 UTC
RemoteUrl https://github.com/arielsotocaro/certainty
RemoteRef HEAD
RemoteSha 72e58c918173ff0ce942b7cfee865d826fbdb39

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add_legend	<i>Customized Legend for CE and RP plots.</i>
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Description

Customized Legend for CE and RP plots.

Usage

add_legend(...)

Arguments

... free

ce_en	<i>Certainty Equivalent Function for Negative Exponential Function</i>
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Description

Certainty Equivalent Function for Negative Exponential Function

Usage

ce_en(profit, rac, weight = 0)

Arguments

profit	data.frame with profit values
rac	scalar of RAC value
weight	original wealth

Value

Scalar with the CE value

ce_epnegative

Certainty Equivalent Computation using Power Utility Function

Description

Certainty Equivalent Computation using Power Utility Function

Usage

```
ce_epnegative(data, rac_ini, rac_fin, weight = 0)
```

Arguments

data	data.frame with profit values
rac_ini	Initial value for the RAC sequence
rac_fin	Final value for the RAC sequence
weight	Original wealth

Value

Generate three objects: A table with the CEs, a vector of risk aversion coefficients RAC, and a plot to compare the CEs.

ce_p

Certainty Equivalent Function with Power Utility Function

Description

Certainty Equivalent Function with Power Utility Function

Usage

```
ce_p(profit, rac, weight = 0)
```

Arguments

profit	data.frame with profit values
rac	scalar of RAC value
weight	original wealth

Value

Scalar with the CE value

ce_power

Certainty Equivalent Computation using Power Utility Function

Description

Certainty Equivalent Computation using Power Utility Function

Usage

```
ce_power(data, rac_ini, rac_fin, weight = 0)
```

Arguments

data	data.frame with profit values
rac_ini	Initial value for the RAC sequence
rac_fin	Final value for the RAC sequence
weight	Original wealth

Value

Generate three objects: A table with the CEs, a vector of risk aversion coefficients RAC, and a plot to compare the CEs.

certainty

Certainty equivalent computation

Description

Certainty equivalent computation

Usage

```
certainty(data, ival, fval, utility, wealth = 0)
```

Arguments

data	data.set with profit for each treatment/project. Each column is a treatment and each row a different profit observation.
ival	The initial value for the RAC vector to employ (scalar).
fval	The final value for the RAC vector to employ (scalar).
utility	Indicator of utility function: "ExpNeg" for the Exponential Negative utility, and "Power" for the Power utility function.
wealth	The initial agent wealth. By default is zero.

Details

This function computes the certainty equivalent values using profit as inputs. Works with `data.frames` with 3 or more observations. Consider each column as a different treatment or project.

Value

This function produces three objects: `CE_values` is a table with treatment by columns and certainty values by row; `RAC` is a vector with the absolute risk aversion coefficients (ARAC) if the Power utility function was implemented, or the relative risk aversion coefficient (RRAC) if the Exponential Negative utility function was implemented. The length of this vector is the same as the number of profit observations in the original dataset; and, `CE_plot` is a graph using `plot` function, to compare the different CEs computed.

References

Hardaker, J.B., Richardson, J.W., Lien, G., & Schumann, K.D. (2004). Stochastic efficiency analysis with risk aversion bounds: a simplified approach. *Australian Journal of Agricultural and Resource Economics*, 48(2), 253-270.

Examples

```
## Example 1. Using profit data from ceRtainty package
data(profitSWG)

# Storing CE values using Power utility function
c1 <- certainty(data = profitSWG,
               ival = .5,
               fval = 4,
               utility = "Power")
c1$CE_values # Table with CE values
c1$RAC       # RAC vector used in CE computation
plot(c1)     # Invoking the CE plot

# To use the ExpNeg function, it is required the RRAC (ARAC/wealth)
# so we can compute the mean value among all profit in the dataset.

# Mean value among all profit value
mean(sapply(profitSWG,mean)) # 5081.844

# Storing CE values using ExpNeg utility function
c1 <- certainty(data = profitSWG,
               ival = .5/5082,
               fval = 4/5082,
               utility = "ExpNeg")

c1$CE_values # Table with CE values
c1$RAC       # RAC vector used in CE computation
plot(c1)

## Example 2. Using the example values of Hardaker et al. (2004)
dt <- data.frame(treatment=c(100,125,135,142,147,150,153,158,163,175,195))
```

```

# Storing CE values using Power utility function. Hardaker use an
# unique RAC value (0.005)
c2 <- certainty(data = dt,
                ival = .005,
                fval = .005,
                utility = "Power")

# or
c2 <- certainty(data = dt,
                ival = .005,
                fval = .005,
                utility = "ExpNeg")

c2$CE_values
c2$RAC
plot(c2)

```

plot.ceRtainty

Plot method for ceRtainty objects

Description

Plot method for ceRtainty objects

Usage

```

## S3 method for class 'ceRtainty'
plot(x, ...)

```

Arguments

x	A ceRtainty object returned by certainty .
...	Further arguments (currently ignored).

Details

Compares the certainty equivalents across treatments over the RAC range stored in the ceRtainty object, choosing the correct plot for the utility function that was used.

Value

Draws a plot of the certainty-equivalent values as a side effect and returns NULL invisibly.

plot_ce_en	<i>Plot for CE using Exponential Negative Utility Function</i>
------------	--

Description

Plot for CE using Exponential Negative Utility Function

Usage

```
plot_ce_en(data, rac = 0, rac_ini = 0, rac_fin = 1, rac_len = 10)
```

Arguments

data	Data set with CE already computed
rac	Scalar with the RAC to use in the CE computation. When the analysis consider only one value of RAC
rac_ini	Vector of the RAC to use in the CE computation. When the analysis consider a sequence of RAC values
rac_fin	Final value for the RAC vector
rac_len	RAC vector length

Value

Plot of CE to compare treatments/projects

plot_ce_power	<i>Plot for CE using Power Utility Function</i>
---------------	---

Description

Plot for CE using Power Utility Function

Usage

```
plot_ce_power(data, rac = 0, rac_ini = 0, rac_fin = 1, rac_len = 10)
```

Arguments

data	Data set with CE already computed
rac	Scalar with the RAC to use in the CE computation. When the analysis consider only one value of RAC
rac_ini	Vector of the RAC to use in the CE computation. When the analysis consider a sequence of RAC values
rac_fin	Final value for the RAC vector
rac_len	RAC vector length

Value

Plot of CE to compare treatments/projects

plot_risk_premium_en	<i>Plot of the Risk Premium values using Exponential Negative Utility Function</i>
----------------------	--

Description

Plot of the Risk Premium values using Exponential Negative Utility Function

Usage

```
plot_risk_premium_en(data, rac_ini, rac_fin, rac_len)
```

Arguments

data	data.frame of CE computed by Exponential Negative function
rac_ini	Initial RAC values used in the CE computation
rac_fin	Final RAC values used in the CE computation
rac_len	Length of the RAC vector used in the CE computation

Value

Plot object

plot_risk_premium_p	<i>Plot of the Risk Premium values using Exponential Negative Utility Function</i>
---------------------	--

Description

Plot of the Risk Premium values using Exponential Negative Utility Function

Usage

```
plot_risk_premium_p(data, rac_ini, rac_fin, rac_len)
```

Arguments

data	data.frame of CE computed by Power Utility function
rac_ini	Initial RAC values used in the CE computation
rac_fin	Final RAC values used in the CE computation
rac_len	Length of the RAC vector used in the CE computation

Value

plot object

premium	<i>Risk Premium computation</i>
---------	---------------------------------

Description

Risk Premium computation

Usage

```
premium(tbase, ce_data, rac, utility)
```

Arguments

tbase	Name of the base treatment/project
ce_data	data.frame with CE values previously computed
rac	Vector with RAC sequence used in the CE computation
utility	The utility function: "ExpNeg" if CE it was computed using Exponential Negative utility function. "Power" if the utility function was Power

Details

This function computes the risk premium values, regarding a project or treatment arbitrarily chosen by the user, using a CEs dataset (a 'certainty' object) already computed.

Value

Generates three objects: A data.frame with the total values of the premium risks; a data.frame with the percentage of difference with respect the base treatment; and a plot with the treatments' premium risk.

Examples

```
## Example using profit dataset
data(profitSWG)

# First, compute the CE values
c1 <- certainty(data = profitSWG, ival = .5, fval = 4, utility = "Power")

ce_values <- c1$CE_values # CE table
ce_rac <- c1$RAC          # RAC vector

# The Risk premium values respect to Serenade treatment
rp <- premium(tbase = "serenade", ce_data = ce_values, rac = ce_rac, utility = "Power")
```

```
rp$PremiumRisk      # absolute values
rp$PremiumRiskPer100 # values in percentage
rp$RP_plot()        # plot
```

profitSWG

Profit SWG

Description

The data come from strawberry trials experiments in Florida, USA, performed by the Gulf Coast Research and Education Center, University of Florida.

Usage

```
data(profitSWG)
```

Format

A data frame with 8 rows of profit and 4 pesticide treatments:

control Control (non-treated case), in US dollars

fracture Fracture treatment, in US dollars

milstop Milstop treatment, in US dollars

serenade Serenade Optimum treatment, in US dollars

Details

Correspond to the profit for three pesticide treatments plus the case without treatment. Four observations for each season, 2014-15 and 2015-16.

Source

Soto-Caro, Wu, Guan (2019). "Evaluating Pest Management Strategies: A Robust Method and Its Application to Strawberry Disease Management". AAEA 2019 Conference.

References

Soto-Caro, Wu, Guan (2019). "Evaluating Pest Management Strategies: A Robust Method and Its Application to Strawberry Disease Management". AAEA 2019 Conference.

Examples

```
data(profitSWG)
summary(profitSWG)
```

rac_generator	<i>RAC Generator function.</i>
---------------	--------------------------------

Description

RAC Generator function.

Usage

```
rac_generator(data, ini, fin)
```

Arguments

data	data.frame object to weight the RAC
ini	The initial value of the risk aversion coefficient (RAC) sequence
fin	The final value of the risk aversion coefficient (RAC) sequence

Details

Create a vector with the adjusted relative risk aversion coefficients to be used in the CE computation, under Power utility function.

Value

Produce a single vector of adjusted RACs.

Examples

```
# Example
data("profitSWG")
rac_generator(data = profitSWG$control, ini = 0.5, fin = 4.0)
```

rac_len	<i>Define the length of the Risk Aversion Coefficient (RAC) vector.</i>
---------	---

Description

Define the length of the Risk Aversion Coefficient (RAC) vector.

Usage

```
rac_len(ini, fin, data)
```

Arguments

- ini The initial value of the RAC sequence.
- fin The final value of the RAC sequence.
- data Original data, could be a vector or a matrix.

Value

Two elements are generated: `r` is the RAC vector, and `length` is a scalar with the number of elements on RAC vector.

<code>rac_seq</code>	<i>Risk Averse Coefficient (RAC) sequence generator</i>
----------------------	---

Description

Risk Averse Coefficient (RAC) sequence generator

Usage

```
rac_seq(ini, fin, len)
```

Arguments

- ini The initial value for the RAC.
- fin The final value for the RAC.
- len The Length of the vector to creates.

Value

Vector of RACs.

<code>RACa</code>	<i>Adjusted Risk Aversion Coefficient (RACa)</i>
-------------------	--

Description

Adjusted Risk Aversion Coefficient (RACa)

Usage

```
RACa(rac, data)
```

Arguments

rac	An scalar with the value of the relative RAC.
data	Dataset to weight the RAC.

Value

This function create an adjustment to the relative risk aversion coefficient, following Hardaker et al (2004).

stoplight	<i>StopLight chart for target-probability analysis</i>
-----------	--

Description

StopLight chart for target-probability analysis

Usage

```
stoplight(data, lco, hco, plot = TRUE)
```

Arguments

data	A numeric vector, or a data.frame whose columns are treatments/projects, holding the values to evaluate (e.g. profit).
lco	Lower cut-off. The threshold below which outcomes are considered unfavourable ("red").
hco	Higher cut-off. The threshold above which outcomes are considered favourable ("green").
plot	Logical. If TRUE (default) a stacked "StopLight" bar chart is drawn comparing the treatments.

Details

For each treatment the empirical cumulative distribution function is used to split outcomes into three zones: below lco (red), between lco and hco (yellow), and above hco (green). This is the "StopLight" representation used in stochastic-efficiency analysis (Richardson & Outlaw, 2008).

Value

A data.frame of probabilities with three rows (Lower, Middle, Higher) and one column per treatment. When plot = TRUE the chart is drawn as a side effect.

References

Richardson, J.W., & Outlaw, J.L. (2008). Ranking risky alternatives: innovations in subjective utility analysis. WIT Transactions on Information and Communication Technologies, 39.

Examples

```
data(profitSWG)
# Single treatment
stoplight(profitSWG$control, lco = 3000, hco = 7000)

# All treatments compared
stoplight(profitSWG, lco = 3000, hco = 7000)
```

summary.ceRtainty	<i>Summary method for ceRtainty objects</i>
-------------------	---

Description

Summary method for ceRtainty objects

Usage

```
## S3 method for class 'ceRtainty'
summary(object, details = FALSE, ...)
```

Arguments

object	A ceRtainty object returned by certainty .
details	Logical. If TRUE, the full table of certainty equivalents and the RAC vector are printed in addition to the descriptive statistics. Defaults to FALSE.
...	Further arguments (currently ignored).

Value

Prints a summary as a side effect and returns object invisibly.

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